REMARKS

In this Amendment, Applicant has amended the Specification to correct minor grammatical and typographical errors, canceled claims 1-19 without prejudice or disclaimer of the subject matter thereof, and added new claims 20-50 to more appropriately define the invention and to protect additional aspects of the invention. In making each of the amendments, Applicant submits that no new matter has been added.

In the Office Action of August 13, 2003, the Examiner rejected claims 1, 2, and 17-19 under 35 U.S.C. § 102(b) as being anticipated by Emery et al.(U.S. Patent No. 5,563,702); rejected claims 3, 4, and 7-16 under 35 U.S.C. § 103(a) as being unpatentable over Emery et al.; and rejected claims 5-6 under 35 U.S.C. § 103(a) as being unpatentable over Emery et al. in view of Aoyama (U.S. Patent No. 5,398,292).

The present invention is an invention relating to an inspection method and apparatus and so on which treat a pattern image to-be-inspected and design data (e.g., in line segment format). More specifically, in the present invention, the inspection is conducted by comparing an edge of the pattern image to-be-inspected and an edge of a reference pattern which has been obtained from design data. That is, the inspection is conducted by comparing the edges with each other. Here, the reference pattern is basically line segment data which represents a group of edges.

In contrast, in prior art such as Emery et al. which is cited in the outstanding Office Action, when an inspection is conducted by comparing the pattern image to-be-inspected and the design data, the design data is converted into an image, and the

image obtained by the conversion is compared with the pattern image to-be-inspected. That is, the inspection is conducted by comparing the images with each other.

Therefore, the present invention is completely different from prior art such as Emery et al.

Applicant respectfully traverses the rejections of the original claims, as detailed above, for the following reasons.

Rejection under 35 U.S.C. § 102(b)

Applicant respectfully traverses the rejection of original claims 1, 2, and 17-19 under 35 U.S.C. § 102(b) as being anticipated by Emery et al. for the following reasons.

Applicant has canceled claims 1, 2, and 17-19 without prejudice or disclaimer of the subject matter thereof, and therefore, their rejection is rendered moot. However, new claims 20 and 22 include, in part, recitations similar to original claims 1 and 2, respectively. Further, new claims 39-47 include, in part, recitations of original claims 17-19. Therefore, claims 20, 22, and 39-47 are discussed below.

In order to properly anticipate Applicant's claimed invention under 35 U.S.C. § 102(b), the Examiner must show that each and every element of each of the claims in issue is found, either expressly described or under principles of inherency, in a single prior art reference. Furthermore, "[t]he identical invention must be shown in as complete detail as is contained in the ... claim." See M.P.E.P. §2131, page 2100-69, 8th Ed., August 2001, quoting *Richardson v. Suzuki Motor Co.*, 868 F.2d 1126, 1236, 9 U.S.P.Q.2d 1913, 1920 (Fed. Cir. 1989). Further, "the elements must be arranged as required by the claim." M.P.E.P. §2131, p. 2100-69.

In the Office Action, the Examiner alleges that "Emery discloses a pattern inspection apparatus having a storage means, inputting means, inspection means for inspecting ... comparing edge..., and outputting means, (see figure 1) as claimed." Office Action at page 2.

Applicant respectfully disagrees with the Examiner's allegations and conclusions because, Applicant submits that, the Examiner has mischaracterized the teachings of Emery et al. Specifically, Figure 1 of Emery et al. discloses a system 10 comprising a stage 12 for carrying a substrate 14 to be inspected, an optical subsystem 16, a data base adaptor 18, an electronics subsystem 20, a display 22, a control computer 24, and a keyboard 26. Id. at col. 7, lines 16-21 and Fig. 1. Emery et al. further discloses that automatic inspection of a reticle ordinarily starts at the upper left hand corner of the care area and follows a serpentine pattern 31 and as the stage slowly moves in the X direction, the laser beam rapidly sweeps in the Y-direction and, thus, a swath 39 is scanned. Id. at col. 12, lines 54-59 and Fig. 3. Further, in the method disclosed in Emery et al., an image data derived from die 33 is compared with the data derived from die 35 and any substantial difference is designated as a defect. Id. at col. 12, lines 60-64. Simply put, Emery et al. merely discloses die-to-die inspection or die-to-database inspection, which is performed by comparing scanned data from adjacent dies or comparing scanned data from die with a simulated image generated by database adaptor, respectively.

Emery et al. does not, however, disclose at least "detecting means for detecting an edge of [a] pattern image to-be-inspected;[and] inspecting means for inspecting said pattern to-be-inspected by comparing the edge of said pattern image to-be-inspected

and an edge of [a] reference pattern," as recited in claim 20. Rather, the method disclosed in Emery et al. merely sweeps a beam in a serpentine path 31 across a plurality of identified substrate subareas. Id. at col. 7, lines 41-47 and Fig. 3. That is, the method of Emery et al. involves a sweep of the entire surface of the subareas and there is no identification of edges.

Furthermore, claim 22 recites, among other things, "inspecting means for inspecting [a] pattern to-be-inspected by comparing an edge of said pattern image to-be-inspected and an edge of said reference pattern; and outputting means for outputting a result of said inspection, wherein said inspecting means conducts matching between said pattern image to-be-inspected and said reference pattern by comparing the edge of said pattern image to-be-inspected and the edge of said reference pattern."

The Examiner alleges that "[Emery et al.] further discloses inspecting means conducts matching...reference...by to be inspected...,(see col. 7, lines 8-10) as claimed." Office Action at page 2. Applicant respectfully disagrees. Emery et al. merely discloses that "[i]n the die-to-database inspection mode a defect is detected by comparing the die under test with corresponding graphics information obtained from the CADS (computer aided database system) database from which the die was derived." Id. at col. 7, lines 8-12. Emery et al. does not disclose inspecting means that "conducts matching between said pattern image to-be-inspected and said reference pattern by comparing the edge of said pattern image to-be-inspected and the edge of said reference pattern", as is required by claim 22.

Because Emery et al. does not disclose each and every element of present claim 22, the claim is not anticipated by Emery et al. and thus, is allowable. Further, present

independent claims 41 and 45 contain recitations similar to allowable claim 22. Therefore, Applicant respectfully submits, claims 41 and 45 are also allowable at least for the reasons set forth regarding claim 22.

Present independent claim 39 recites, among other things, "wherein said inspecting means forms a profile by examining luminance values in a profile acquisition section in said pattern image to-be-inspected, detects predetermined points for each said profile, approximates the detected points with a curve, and assumes the curve to be an edge of said pattern image to-be-inspected."

The Examiner alleges that "[Emery et al.] discloses the profile on pattern image to be inspected, detects predetermined points...assumes the curve to be an edge..., (see col. 16, lines 5-20) as claimed." Office Action at page 2. Applicant respectfully disagrees. Emery et al. discloses a system that measures intensity distributions that are used to determine the line width of a feature on a mask. More specifically, Emery et al. discloses a feature 274 and a system measures the intensity at equidistant points 276, and these intensity measurements are used to determine the line width of the feature. Id. at col. 15, line 62 - col. 16, line 4 and Fig. 14. In the portion quoted by the Examiner, Emery et al. further discloses that at each grid point, the intensity is the convolution of the point spread function of the optical system with the transmissivity profile of the feature. Contrary to the Examiner's allegation, Emery et al. does not disclose at least "inspecting means forms a profile by examining luminance values in a profile acquisition section in said pattern image to-be-inspected, detects predetermined points for each said profile, approximates the detected points with a curve, and assumes the curve to be an edge of said pattern image to-be-inspected," as recited in

claim 39. Therefore, a rejection of claim 39 under 35 U.S.C. § 102(b) would be improper, and Applicant requests the Examiner that this claim also be allowed.

Further, claims 43 and 47 contain recitations similar to allowable claim 39. Therefore, claims 43 and 47 are also allowable at least for the reasons set forth above regarding claim 39.

Present independent claims 40 and 44 contain recitations similar to claim 20. Specifically, claims 40 and 44 recite, *inter alia*, "a detecting step of detecting an edge of [a] pattern image to-be-inspected; an inspecting step of inspecting said pattern to-be-inspected by comparing the edge of said pattern image to-be-inspected and an edge of said reference pattern stored in storage means." For the reasons mentioned above regarding claim 20, Emery et al. does not disclose at least the above-quoted recitation of claims 40 and 44. Therefore, applicant respectfully requests claims 40 and 44 also be allowed.

Present independent claims 42 and 46 recite, among other things, "wherein said inspecting step assumes the correspondence of the edge of each pixel of said reference pattern to the edge of each pixel of said pattern image to-be-inspected." Because Emery et al. does not disclose at least the above quoted element of claims 42 and 46, these claims are not anticipated by Emery et al. Accordingly, Applicant respectfully requests the Examiner to allow claims 42 and 46 as well.

In summary, because Emery et al. does not disclose each and every element of new claims 20, 22, and 39-47, Applicant respectfully submits, new claims 20, 22 and 39-47 are allowable over Emery et al.

Rejection under 35 U.S.C. § 103(a)

Applicant respectfully traverses the rejection of original claims 3-4, 7-16, and 5-6 under 35 U.S.C. § 103(a) because a *prima facie* case of obviousness has not been established by the Examiner.

In order to establish a *prima facie* case of obviousness, three basic criteria must be met. First, the prior art reference (or references when combined) must teach or suggest all the claim elements. Second, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify a reference or to combine reference teachings. Third, there must be a reasonable expectation of success. *See* M.P.E.P. § 2143.

I. New claims 23, 28, and 30-38 (corresponding to original claims 3-4 and 7-16)

The Examiner rejected claims 3-4 and 7-16 under 35 U.S.C. § 103(a) as being unpatentable over <u>Emery et al.</u> Specifically, while the Examiner admits that "[<u>Emery et al.</u>] fails to explicitly disclose the edge detection features as disclosed in claims 3-4 and 7-16, as dilation, weighting, correspondence assumption," the Examiner states that <u>Emery et al.</u> discloses different embodiments and "col. 28, lines 25-49 states the dilation process for the purpose of edge detection. Therefore, it would have been obvious to one ordinary skill in the art at the time of the invention to simply take the suggestions of Emery and develop another inspection system that carry out the inspection of the pattern using the known edge detection system." Office Action at pages 3-4. Applicant respectfully disagrees.

New claim 23 includes, in part, recitations of original claims 3 and 4; and new claims 28, and 30-38 include, in part, recitations of original claims 7-16. New claim 23 depends from claim 22. As discussed above, Emery et al. does not alone teach or suggest each and every element of independent claim 22. Since the Examiner has not combined Emery et al. with any other reference, and since at least because Emery et al. fails to teach or suggest each and every element of independent claim 22, as noted above, the Examiner has failed to establish a *prima facie* case of obviousness for any claims dependent from claim 22. Accordingly, Applicant respectfully submits that claim 23, which depends from claim 22, is also allowable at least in view of its dependency from allowable claim 22.

Moreover, claim 23 recites, among other things, matching is conducted by dilating the edge of a pattern image to-be-inspected or the edge of a reference pattern. In contrast, Emery et al. merely discloses the use of dilation process as a standard binary morphological operation in generating a reference mapping process where the nominal behavior of a substrate type is observed by a representative sampling of a defect-free area of a selected number of substrates of the same type to account for production tolerances. Emery et al. does not teach or suggest at least matching conducted by dilating the edge of a pattern image to-be-inspected or the edge of a reference pattern, as recited in claim 23.

Further, the Examiner has failed to address all the recitations of original claims 7-16, which are included, in part, in new claims 28 and 30-38. For example, claim 28 (which includes recitations corresponding to original claim 7) recites, among other things, matching is conducted by altering for each part of a reference pattern, a

contribution thereof to the matching. <u>Emery et al.</u> does not teach or suggest at least this recitation. Accordingly, because the Examiner failed to address, and <u>Emery et al.</u> does not teach every recitation of original claims 7-16 or the corresponding new claims 28, and 30-38, Applicant respectfully submits that the rejection of these new claims would be improper under 35 U.S.C. § 103(a) and respectfully requests the Examiner to allow the new claims 28, and 30-38.

II. New claims 25 and 27 (corresponding to original claims 5 and 6, respectively)

The Examiner rejected original claims 5 and 6 under 35 U.S.C. § 103(a) as being unpatentable over <u>Emery et al.</u> in view of <u>Aoyama</u>. While the Examiner admits that "[Emery et al.] fails to explicitly disclose the sum of product process," the Examiner attempts to cure this deficiency by stating that "Aoyama disclose the sum of product process in doing mask inspection. Therefore it would have been obvious to one ordinary skilled in the art at the time of the invention to combine the two references as they are analogous because they are solving the similar problem of mask inspection." Office Action at page 4. Applicant respectfully disagrees.

New claims 25 and 27 include, in part, recitations similar to those in original claims 5 and 6. Further, new claims 25 and 27 depend, directly or indirectly, from independent claim 22. As discussed above, <u>Emery et al.</u> does not teach or suggest each and every element of independent claim 22. <u>Aoyama</u> fails to cure this deficiency. Specifically, <u>Aoyama</u> does not teach or suggest at least "inspecting means for inspecting [a] pattern to-be-inspected by comparing an edge of said pattern image to-be-inspected and an edge of said reference pattern; and outputting means for outputting

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a result of said inspection, wherein said inspecting means conducts matching between said pattern image to-be-inspected and said reference pattern by comparing the edge of said pattern image to-be-inspected and the edge of said reference pattern," as recited in claim 22.

Therefore, at least because Emery et al. and Aoyama, either taken alone or in combination, fail to teach or suggest each and every element of independent claim 22, the Examiner has failed to establish a *prima facie* case of obviousness for claims 25 and 27, which depend from claim 22. Accordingly, Applicant respectfully submits that claims 25 and 27 are also allowable at least in view of their dependency from allowable claim 22.

Further, Applicant respectfully disagrees with the Examiner's statement that "it would have been obvious ... to combine the two references as they are analogous because they are solving the similar problem of mask inspection." Office Action at page 4. Emery et al. discloses a method and apparatus for inspecting patterned transmissive substrates, such as photomasks. Id. at Abstract. In contrast, Aoyama relates to an apparatus for detecting an edge appearing in a picture, and more specifically to an edge detecting apparatus for detecting a white line on a road based on the image formation of the road surface in order to implement automatic driving of a vehicle. Contrary to the Examiner's statement, the two references, one directed to inspection of photomasks and the other directed to detecting a white line on a road, are not analogous. Therefore, there is no motivation to combine the teachings of Emery et al. with those of Aoyoma.

Still further, claim 25 recites, among other things, matching is conducted by using the total sum of products of amplitudes of the edges of said pattern image to-be-

inspected and amplitudes of the edges of said reference pattern at respective pixels as an evaluation value. Claim 27 recites, among other things, matching is conducted by using the total sum of inner products of edge vectors of said pattern image to-be-inspected and edge vectors of said reference pattern at respective pixels or the total sum of absolute values of said inner products as an evaluation value, wherein each of said edge vectors has a magnitude equal to amplitude of the edge and a direction identical to the direction of the edge.

In contrast to claims 25 and 27, Aoyama discloses an edge detecting apparatus which comprises edge detecting means comprising a plurality of edge detecting masks, each having a sensing directivity to a specific direction fixed to each and arranged with each directivity direction shifted by a given angular interval from the neighboring masks. Aoyama further discloses that the edge output selecting means selects the edge detecting mask that exhibits the maximum sum-of-products value among others. Id. at col. 3, lines 23-26. In other words, the edge detecting means disclosed in Aoyama merely detects an edge by selecting a mask from a plurality of masks each having a sensing directivity fixed to a specific direction. Emery et al. and Aoyama, either taken alone or in combination, do not teach or suggest the recitations of claims 25 and 27.

Because Emery et al. and Aoyama, either taken alone or in combination, do not teach or suggest the recitations of claims 25 and 27, and there is no motivation to combine the teachings of Emery et al. with those of Aoyama, the Examiner has failed to establish a *prima facie* case of obviousness for claims 25 and 27. Accordingly, Applicant respectfully requests the Examiner to allow these claims.

III. New claims 21, 24, 26, and 29

New claim 21 depends, directly, from claim 20; and new claims 24 and 26 depend, directly or indirectly, from claim 22. At least for the reasons set forth above regarding claims 20 and 22, Applicant respectfully submits, claims 21, 24, 26, and 29 are allowable and accordingly, Applicant respectfully requests the Examiner to allow these claims.

Further claim 21 recites, among other things, "detecting means detects the edge of [a] pattern image to-be-inspected with a sub pixel accuracy." Claim 24 recites, among other things, "matching is conducted by dilating the edge of [a] pattern image to-be-inspected or the edge of said reference pattern with weightings given." Claim 26 recites, among other things, "matching is conducted by calculating an evaluation value of the matching in consideration of a direction of the edge of [a] pattern image to-be-inspected and a direction of the edge of said reference pattern." Claim 29 recites, among other things, "matching is conducted by extracting a unique pattern by using periodicity of said reference pattern, and setting different weightings for an evaluation value of the matching depending on whether pattern in said reference pattern is the unique pattern or not." Applicant respectfully submits that Emery et al. and Aayoma, either taken alone or in combination, do not teach or suggest at least these recitations of claims 21, 24, 26 and 29.

IV. New claims 48-50

New claims 48 and 49 depend from claims 20, 22, 30, or 39, in multiple dependent form. New claim 40 depends from claim 49. At least for the reasons set forth above regarding claims 20, 22, 30, and 39, Applicant respectfully submits, claims

48-50 are allowable and accordingly, Applicant respectfully requests the Examiner to allow these claims.

Conclusion

In view of the foregoing, Applicant respectfully requests the reconsideration and reexamination of this application and the timely allowance of the pending claims 20-50.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

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Dated: December 12, 2003

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